PRO-ACT
A Base-level Pollution Prevention Resource sponsored by HQ Air Force Center for Environmental Excellence

# SUCCESS STORY

Wright-Patterson AFB - FEBRUARY 2001

## *SPOTLIGHT ON:*
## Aeronautical Systems Center, Acquisition Environmental, Safety and Health Division Wright-Patterson AFB

### Wright-Patterson AFB Success Stories



## Introduction

The Aeronautical Systems Center (ASC) has been the nation's premiere military aeronautics organization for almost 40 years, and is home to the largest engineering directorate (ASC/EN) under the Air Force Materiel Command (AFMC). ASC/EN's mission encompasses engineering test and evaluation, and support of weapon systems and related equipment. An integral component of ASC/EN is the Pollution Prevention Division of the Acquisition Environmental, Safety and Health Division Engineering Directorate (ASC/ENV). ASC/ENV is responsible for incorporating pollution prevention (P2) strategy and environmental protection into the weapon systems acquisition process. The ASC/ENV division encourages the reduction of hazardous material usage in weapon systems by providing environmental oversight to the System Program Offices (SPOs). The SPOs are responsible for acquisition programs including the F-15, F-16, F-22, Joint Strike Fighter (JSF), B-1, B-2, C-17, special operations aircraft, training systems, and aircraft engine programs. ASC/ENV also manages pollution prevention programs at each of the Air Force's Government Owned, Contractor Operated (GOCO) industrial plants, valued in excess of $3 billion.

## Commitment to Excellence

Over the past several years, ASC/ENV has received commendable recognition for its role in encouraging pollution prevention stewardship by developing and transitioning environmentally friendly materials, systems, and processes into the weapon system, and minimizing environmental impacts to cost, schedule, and performance over the life cycle of weapon systems. ASC/ENV's monumental efforts have not gone unnoticed. To date, the division's accomplishments have earned them the following:

- 1996 General Thomas D. White Pollution Prevention Team Award
- 1996 Department of Defense Citation for Meritorious Achievement in Pollution Prevention
- 1998 Honorable Mention, Department of Defense Environmental Security Award
- 1998 General Thomas D. White Pollution Prevention Team Award
- 1998 Department of Defense Citation for Meritorious Achievement in Pollution Prevention
- 1999 Honorable Mention, White House Closing the Circle Award
- 1999 Commander in Chief's Special Recognition for Installation Excellence
- 2000 Nominee, White House Closing the Circle Award
- United States Environmental Protection Agency Stratospheric Ozone Protection Award

The ASC/ENV division attributes its success to innovative, cost effective, environmentally friendly initiatives. To achieve these goals, the team set forth with a three part strategy including:

- **Education** - The ASC/ENV division ensures that their environmental engineers and specialists become well-educated to the environmental, safety, and occupational health considerations through training programs.
- **Early pollution prevention in weapon system life cycles** - ASC/ENV includes bringing pollution prevention into the concept, design, development, production, deployment, training, maintenance, and disposal of each weapon system. Each weapon system manager is tasked to address the cost of pollution as part of overall life cycle cost and make program decisions to minimize cost.
- **Technology and Innovations** - ASC/ENV partnered with various Air Force and joint service organizations to develop and transition new

environmentally friendly technology for use in weapon systems. Each technology is intended to reduce pollution, improve performance, protect worker health and safety, and reduce costs. Where suitable substitutions are not feasible, the division seeks procedures to reduce and minimize hazardous material uses in current processes.

As a result of ASC/ENV's efforts, several environmental technologies and innovations have been implemented, and millions of dollars in life cycle costs have been saved. The following discussion will provide summaries of the team's outstanding pollution prevention accomplishments that have contributed to military readiness through cost reductions and reduced hazards to personnel and the environment.

# Education & Outreach

## NEPA Course

ASC/ENV developed a forward approach to incorporate environmental decisions into the acquisition process. Each SPO uses a National Environmental Policy Act (NEPA) process for making decisions. The home office developed the standard Environmental Impact Analysis Process (EIAP) Operating Instruction, trained SPO personnel to use it, and developed a web-based instruction guide that provides real-time information to help SPO personnel accomplish required NEPA documentation. The process has allowed program managers to establish program-specific NEPA evaluations, resulting in overall time and cost avoidances.

## The Monitor

ASC/ENV is committed to disseminating environmental information and has made spreading pollution prevention innovations and information to the SPOs, Collocates, DoD, and the public a top priority. The AFMC Pollution Prevention Integrated Product Team (P2-IPT) summarizes environmental success in *The Monitor*, a quarterly publication dedicated to integrating environment, safety, and health related issues across the entire life cycle of Air Force Weapons Systems. *The Monitor* includes articles on compliance and pollution prevention, and provides contact information to readers. Volumes are kept online for two years and can be accessed on the World Wide Web at the ASC website, **http://www.ascenv.wpafb.af.mil/monitor.htm**.

## Solutions Database

The Solutions Database is an informative tool that the P2-IPT is developing to make pollution prevention project information more accessible. The database is a management system that summarizes historical P2 projects, and is intended to provide guidance information for investment decisions. Weapons systems designers and ASC/ENV personnel access the database to determine whether pollution prevention requirements have been identified and/or resolved. If a requirement has not been resolved, ASC/ENV will prioritize the need within an investment roadmap and search for potential sources of funding. As of Spring 2000, over 200 projects from Calendar Year 1994-1999 had been identified for inclusion into the Solutions Database. Once a project is identified, seventeen data elements are collected for each of the projects and compiled in a Microsoft Access Database. There are approximately 60 "needs" from the Environmental Safety & Occupational Health Technology Planning Integrated Product Team (ESOH TPIPT), indicating Air Force requirements have been tied to projects in the Solutions Database. Projects can represent a one-to-one solution, or serve as examples of successful methods that could be used in similar circumstances. The linking of solutions to needs clearly demonstrates that the Air Force is working to solve problems in a systematic manner. For more information on the Solutions Database, contact Mr. Frank Brown, ASC/ENVV, DSN 785-3059, ext. 310.

## Acquisition Training Course

ASC/ENV developed the *Pollution Prevention (P2) Acquisition Training Course*, which has equipped over 600 SPO engineers with guidance and tools. The division also deployed the P2 Virtual Classroom Course, which has saved over $300,000 per year in travel and training costs. The home office developed and provided P2 handbooks on all weapon system acquisition phases to all AFMC Product, Test, and Air Logistics Centers. Personnel from ASC/ENV also attended many environmental exhibitions in order to create P2 awareness in the acquisition training course. Information on training can be accessed on the ASC/ENV website at **http://www.ascenv.wpafb.af.mil**.

# P2 Technology & Innovations

## Advanced Performance Topcoat

ASC/ENV supports the C-17 program, one of the Air Force's largest weapon system acquisition programs, which demands an aggressive pollution prevention plan. Aircraft in combat environments require a stable matte finish and a coating that scatters light rather than reflecting. The flattening agents used in the traditional matte finishes to meet these requirements add weight to the aircraft, make surfaces hard to clean, are costly

to maintain, and require repainting every two to three years. When the EPA began requiring the use of specially designed paint hangars for conventional coating practices, the C-17 SPO office was prompted to look for a pollution prevention alternative to building the new hangars. The Pollution Prevention Integrated Product Team (P2-IPT) and the C-17 SPO partnered with the Boeing Company to develop an advanced performance topcoat that features enhanced cleanability and weatherability. The team evaluated nine different technologies and 24 different materials before deciding on a fluorine-modified polyurethane paint. Phantom Works developed the extremely durable advanced-performance coating for military aircraft, which is projected to save the Air Force around $600 million in life-cycle costs on the C-17 airlifter and KC-135 tanker alone. It could save billions of dollars when extended to other military aircraft. Currently, two dozen C-17s have been coated with the new paint, and all new and operational C-17 repaints will receive it in the future. The new topcoat has also been successfully used on all 588 KC-135 operational tankers. Estimated cost savings are around $500 million for the KC-135 and $117 million for the C-17. At this time, evaluations are underway to determine the performance on the F-15 aircraft, and consideration is being given to using the paint on KC-10 tankers. By the end of calendar year 1999, the program boasted a 79 percent reduction of EPA-17 priority pollutants. For more information on the new topcoat, contact Captain Joel Almosara, Environmental Program Manager, ASC/ENVV, C-17 SPO, DSN 986-9311.

## Cadmium Replacement

The environmental engineers and specialists at ASC/ENV have made great progress in developing environmentally friendly technology to replace cadmium plating on aircraft components. Since cadmium is an Environmental Protection Agency (EPA)-17 priority pollutant, and is used in large quantities on the majority of all military aircraft landing gear, it was very important to find an alternative landing gear plating process that offered equivalent corrosion protection, while reducing both the health risk to workers and damage to the environment. The result is a revolutionary technology that employs Ion Vapor Deposition (IVD) on exterior surfaces and Sputtered Aluminum for interior surfaces of landing gear components. The IVD and Sputtered Aluminum processes have proven to be acceptable environmentally-friendly alternatives to cadmium plating for high strength alloy steels used on landing gear parts. These “green” processes will eliminate approximately 350,000 pounds of cadmium waste per year at Hill AFB alone, and ultimately save the government millions of dollars in operation, maintenance, and health risk cost avoidance, associated with continued plating process operations that are reliant on hazardous materials and their disposal. For more information, contact Mr. Chuck Valley, Environmental Program Manager, ASC/ENVV, DSN 785-3054, ext. 332.

## Chromium Replacement

In an effort to reduce the EPA-17 priority pollutant, chromium from aircraft components, ASC/ENV initiated the use of the High Velocity Oxygen Fuel (HVOF) process. HVOF is used to replace chrome plating for “non-line of sight” applications (e.g. small components and tight internal diameters), and will provide more durable, longer service life and reduced costs. The new plating offers better operational performance, is lighter, has little or no fatigue debit, and typically provides three times the service life of traditional chrome plating. HVOF also eliminates worker exposure to hexavalent chrome, is more damage tolerant than hard chrome, provides a significant reduction in turn-around time to repair, and has better compatibility with hydraulic seals. For more information, contact Mr. Chuck Valley, Environmental Program Manager, ASC/ENVV, DSN 785-3054, ext. 332.

## Appliqué

ASC/ENV has taken the lead for managing flight test programs to research environmentally friendly technology to replace traditional aircraft paint that includes replacing chrome with a non-chrome, zero volatile organic compound appliqué top film. Current aircraft paint systems depend heavily on large volumes of volatile organic compounds and heavy metals, such as methylene chloride, methyl-ethyl ketone, and chromium. These compounds pose a serious threat to the environment and to the health of workers at aircraft maintenance depots. At this time, ASC/ENV has an ongoing technology exploration contract with 3M to flight test and perform environmental characterization for a potential topcoat replacement. Mr. Charles Valley, Environmental Scientist and Manager of the Applied Technology Program in ASC’s Acquisition Environmental Management Division, described “appliqué” as a zero-volatile organic compound film that is applied to a primered aircraft. Besides being an environmentally friendly alternative topcoat, appliqué has the potential to save millions of dollars annually in operation, maintenance, and health risk costs. “We are currently considering flying a “primerless” appliqué film to prove that the entire paint system (both primer and topcoat) can be replaced with applique film, which will totally eliminate the chrome currently relied upon for the exterior surfaces of military aircraft,” reports Mr. Valley.

This topcoat covering, which is similar to contact paper, replaces the traditional sprayed-on high-VOC topcoat paint. The film, manufactured by 3M, is a fluorinated polymer material with design characteristics similar to those of traditional paint topcoats, but without the hazardous materials. Aircraft technicians apply appliqué by cutting the topcoat film, which has an adhesive backing, into specific shapes, and then positioning them over the aircraft surface to be covered. Appliqué can be used on most sections of an aircraft, except high temperature areas such as those adjacent to the engines. In the past, "appliqué" has been used for decals on commercial airliners and tested as belly protection on military cargo aircraft. Although an F-15B (Figure 1) was first used as the flying testbed in an earlier phase of exploration of the appliqué technology, an F-16 is serving to further evaluate the technology. Testing involves flying the "chase and target" aircraft at variable speeds within a normal flight envelope up to mach 1.65. According to Mr. Valley, the "project is still in the testing phase; however, if the appliqué process proves successful, it will represent another milestone in replacing depot processes which rely on hazardous materials. This environmentally-friendly process also could represent a turning point in how supersonic military aircraft are painted during manufacture and maintenance cycles." Initial indications from the flight test program have been positive.

Success of ASC/ENV's Applied Technology Program identifies this organization as the leading Air Force agency for the "Appliqué" program. Engineers at Warner-Robins Air Logistics Center in Georgia are also investigating similar uses of the appliqué technology on military cargo aircraft. For more information, contact Mr. Chuck Valley, Environmental Program Manager, ASC/ENVV, DSN 785-3054, ext. 332.

## FLASHJET ®

Partnered with engineers and scientists at Warner Robins Air Logistics Center (WR-ALC) in Georgia, ASC/ENV tested a new aircraft paint removal process that supports pollution prevention initiatives, while protecting human health and the environment. The $4 million Composite Depaint Project resulted in a new robotic paint stripping design, known as the FLASHJET®. The process uses a pulsed light energy system that incorporates frozen carbon dioxide (CO2), dry ice, for cleaning the stripped surface, supported by another system that captures particles generated in the cleaning process. The pulsed light energy comes from an electrically energized xenon lamp that emits light onto the painted surface. The surface coating absorbs (photon) energy, heats to the point of pyrolysis, where it changes into fine ash particles. While the cleaning process is occurring, the CO2 system provides cooling to the surface area, which maintains the desired paint stripping temperature. The CO2 stream also helps to clear particulates away from the flashlamp window, which increases the opportunity for constant maximum light transmission. In addition, the stream sweeps away coating residue from the surface. Another added benefit over current chemical processes, is that the low pressure system applied


**Figure 1: F-15 Applique Zones "Paintless" Aircraft**

by the pulsing FLASHJET® process prevents damage to substrates (the surface being cleaned), particularly composites. Since dry ice particles change from a solid to a gaseous state upon impact, all of the removed coating is vacuumed away from the substrate by the effluent capture system and collected in High Efficiency Particulate Arrestants (HEPA) filters. The remaining effluent vapors are collected in an activated charcoal air scrubber, leaving the resulting discharge totally clean, and limiting the hazardous waste disposal to the volume of paint particles trapped in the HEPA filters. The flashlamp can be controlled for strength of the photon beam, pulse rate (flashes per second), and rate of travel over the surface. The dry ice particle stream also can be controlled for mass flow rate of particles, delivery pressure, and delivery nozzle angle. A color sensor, in turn, controls the depth of the stripping process, as the sensor enables the flashlamp to fire only on selected colors and is capable of determining the difference between topcoats, primers, and substrates.

The technology is recognized as the largest pollution prevention initiative placed on contract through the Applied Technology Program and is a major milestone for ASC/ENV and Warner Robins ALC. The innovative paint removal project will potentially reduce the use of thousands of gallons of methylene chloride and methyl ethyl ketone, which are currently used in depot paint stripping operations and are EPA-17 priority pollutant chemicals. The goal of the project is to identify and provide alternative processes for systems currently using hazardous substances. The Applied Technology Program is successful because it produces quick, tangible "environmental victories" as in the case of the Composite Depaint Project and IVD and Sputtered Aluminum projects. Because more military aircraft, both subsonic and supersonic, are using composites to reduce the acquisition cost and weight of the aircraft, there is an increasing demand for paint-stripping processes that are accommodating to these composite structures. Since chemicals can etch and eventually threaten the mechanical integrity of composite structures like aircraft radomes and thin-skinned aging aircraft, a viable, environmentally-compliant, alternative, paint stripping process was needed. The FLASHJET® paint-stripping system (Figure 2), is intended for the F-15, C-141, C-130 and potentially the C-17 programs. Sharing his enthusiasm about the project, Dr. William White, Chief Scientist at WR-ALC said, "There appears to be no limit in using the unique capabilities of this process to strip composite parts." ASC/ENV emphasized that the Composite Depaint Project provides an excellent example of the successes that can be achieved through partnering efforts with the Air Logistics Centers.

For more information, contact Mr. Chuck Valley, Environmental Program Manager, ASC/ENVV, DSN 785-3054, ext. 332.


**Figure 2: FLASHJET® Stripping System**

## Environmental Aircraft Battery

ASC/ENV teamed with the AFRL/PRPB to fund efforts to eliminate cadmium and lead from aircraft batteries. The resulting technology is the first Environmental Aircraft Battery (EAB) which is a sealed, maintenance free, replacement for the F-16 Pre-Block 40 vented Nickel-Cadmium (VNC) 17 Amp-hour battery. The new battery will eliminate around 800,000 pounds of hazardous waste a year. Although the cost for the new environmental aircraft battery from start to finish is around $3 million, the battery will save an estimated $50 million per year in aircraft battery purchase and maintenance. The battery also offers longer life, lower weight, and higher energy density. SAFT America Incorporated developed the battery for the F-16, F-22, and C-130 aircraft, and other program offices have shown interest in the battery. For more information, contact Mr. Vincent Johnson ASC/ENVV, DSN 785-3054.

## Non-ODS Tube Cleaning

ASC/ENV responded to regulatory requirements to create a replacement for trichlorofluoroethane (CFC-113), a Class I Ozone Depleting Substance (ODS), used in support of oxygen system component cleaning for the B-2 bomber. Tube assemblies for primary and back-up oxygen systems come into contact with lubricants and shop soils, and if not properly cleaned could jeopardize safety. The current cleaning process for tubes involve immersion in a tank of Brulin 815 GD and a final cleaning with CFC-113. An extracted sample of CFC-113 is then analyzed to determine the cleanliness level of the interior of the tube assembly. The new technology, known as Proceco™, uses an aqueous degreaser for pre-cleaning by pumping

cleaning solution, rinse water, and air through a manifold, and then directing it into the tubes and overhead spray nozzles. To eliminate the use of an ODS as the final cleaning agent and verification step, a portable cart is used by the tube shop. The solvent cart is equipped with various sized tubes, a solvent reservoir, filter, and pump to circulate the fluid. Worker contact and solvent emissions are minimized. Studies have illustrated that aqueous tube cleaning has achieved higher level cleaning than vapor degreasing. This system is expected to pioneer technology that will replace other undesirable solvents applicable to all DoD services, and aide in the elimination of Class I ODSs. For more information, contact Mr. Jared Scott, Project Manager, ASC/ENVV 785-3084, ext. 335.

## Hydraulic Fluid Recycling

The Air Force spends approximately $30 million per year in the disposal and replacement of used hydraulic fluid. ASC/ENV and the Air Force Research Laboratory, Materials and Manufacturing Directorate, Airbase and Environmental Technology Division (AFRL/MLQ) have developed a hydraulic fluid purification project. The Pall Aeropower Corporation supplied a vacuum dehydration, spinning disc process to remove water, air, volatile organic solvents, and particulate matter from the fluid. The purifier incorporates a state-of-the-art water sensor that automatically shuts off the equipment after a level of cleanliness has been reached. Tests have shown that the purifier sufficiently cleaned hydraulic fluid without degrading the fluid characteristics, and proved that the purifier is logistically supportable. The average Air Force base can expect to invest less than $34K for two purifiers to reap the full benefits of the process. Reductions of waste hydraulic fluid are expected to be around 75 percent. For more information, contact Mr. Donald Streeter, ASC/AAA, DSN 785-7210, ext. 3553.

## Deicing Innovations

ASC/ENV has led the effort to develop a Military Test Method Standard (MTMS) designed to guide and support the qualification and testing of new ice control materials that will be acceptable for military aircraft operations. The recent introduction of more environmentally-friendly ice control materials for aircraft and runways/taxiways to meet new Environmental Protection Agency requirements has raised concerns about their compatibility with some military aircraft materials. Prior studies revealed cases of material property deterioration resulting from exposure to specific ice control materials. As part of the information gathering for the MTMS development effort, a detailed survey was conducted on a wide range of Air Force stakeholders and manufacturers to learn of their experiences and concerns regarding the new ice control materials now available. This study revealed that existing Society of Automotive Engineers (SAE) Aerospace Material Specifications(AMS), specifically Aerospace Materials Locator Service AMS 1424, AMS 1428, AMS 1431, and AMS 1435, are adequate for qualifying ice control materials for use with civilian aircraft. However, many military aircraft materials are not covered adequately, or not at all, by the qualification tests of these specifications. In developing the MTMS, the AMS specifications were studied in detail in order to formulate recommendations to the SAE on integrating the standardized specifications to more effectively reflect Air Force and DoD aircraft needs. For more information, contact Ms. Mary Wyderski, F-16 SPO Environmental Program Manager, ASC/ENVV, DSN 986-6718.

# Team Success

ASC/ENV has successfully incorporated the Air Force's pollution prevention message into each of its functions, leading efforts to develop and implement pollution prevention solutions throughout the Air Force weapon system programs. During PRO-ACT's visit, it was apparent that the environmental successes achieved by ASC/ENV have been a joint effort between the division and System Program Offices. ASC/ENV's many pollution prevention achievements illustrate that each member of the team is committed to fostering partnerships and alliances within the environmental, weapon system acquisition, engineering, research and development, and industry communities. By harnessing the technological innovation and forward looking approaches, ASC/ENV has already demonstrated tremendous success that will provide a positive environmental, safety, and occupational health impact to the way Air Force and joint service weapon systems are developed and maintained for decades.

***Need more information?***
***Contact PRO-ACT at DSN 240-4214, (800) 233-4356, or pro-act@hqafcee.brooks.af.mil.***

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